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ABSTRACT

The author defines individualization in instruction and suggests possible elements of individualization in mathematics classes. Some described elements include (1) individual responses to common assignments, (2) individual paths to the same objectives, (3) different objectives for different students, (4) different completion times for the same objectives, and (5) individually selected problems. He then describes programs for individualization now in existence. These include Individually Prescribed Instruction (IPI), Westinghouse's Project PLAN, Individualized Mathematics Teaching (IMV) in Sweden, and programs in the following locations; Dade County, Florida, Nova H.S. in Fort Lauderdale, Florida, and Hopkins, Minnesota. Problems of implementation of programs, and evaluative research results are discussed. The author concludes that many different types of activities should be included, extensive planning is essential, and that some group activity should be retained in individualized instruction programs in mathematics. (CT)

INDIVIDUALIZATION OF INSTRUCTION IN JUNIOR HIGH SCHOOL MATHEMATICS

(Talk delivered to the Montreal, Canada regional meeting of the National Council of Teachers of Mathematics. 11:00 a.m., November 6, 1970.)

By

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INDIVIDUALIZATION OF INSTRUCTION IN JUNIOR HIGH SCHOOL MATHEMATICS

In answer to the question, "What is happening in individualized instruction in Junior High School Mathematics?", I would say, "Not much." To give some perspective to that last statement, let me examine another question,

"What is an individualized program?" There is confusion concerning the idea of individualization. The word implies many different things to different people.

To some people a math lab such as the one run by Lola June May in Winnetka is individualization.

To some people a programmed instruction course is individualization.

To some, students progressing at their own rate through a course is individualization.

To still others, a child working alone or independently represents individualization.

I could go on with my list, but to a certain extent the statements are all true and all misleading. Each of the examples is misleading because it is only a part of the story.

General definition of individualization. Individualization is the act of improving instruction by using and taking into account the individual or unique characteristics of the student.

I don't see how that could mean anything to anyone but me.

Let me try to put some flesh on the statement.

(a) Common assignment, individual response.

If we ask each student to find three ways that mathematics is important in a person's life and write a one-page report, this could represent an aspect of an individualized program, even though it is an assignment given to an entire class.

Each student will make a unique response to the assignment. If we, as teachers, treat each report as the work of an individual, - if we see the report as part of a conversation between the student and the teacher - if we avoid trying to make all the reports fit the mold of some ideal report, then a group assignment can be an important part of individualization.

I am pressing this point because I feel that individualized programs lose something when there are no group assignments. Group activities tell us that we are doing something that is important. The activity is certified by the number of people engaged in the activity.

Group activities allow us to talk among each other about the common assignment.

I feel that we should keep many group activities but that we should learn that each student will bring and take away something different. We should accept this range of response and actually use the differences in building a stronger program.

(b) Common objectives for all students, but provide

individual paths to the objectives.

We may wish all the students to learn to multiply on the slide rule. One student may learn best by working through practical examples beginning with simple procedures. Another student may learn best by watching someone else work through a set of problems so that he is not confused by having to make the manipulations while he tries to figure out what is going on. Another student may learn best by starting with a theoretical description of a logarithmic scale. Still another may learn best by actually making a slide rule. I hope that my example is convincing. A single instructional approach will not be equally effective with all students.

Different objectives for different students. Any time a student makes an elective decision, we have taken an individualization step. Every time that we assign some students to one course and other students to another course according to what we think will be best for them, we are individualizing. Each group of students will emerge with different experiences and skills. The algebra student will of course have different skills than the student who takes shop mathematics.

The problem with individualization by course selection or course assignment is that the chunk of instruction is often too great and the cost of a bad estimate of the student seems to be too great. A student may be forced to sweat out a "D" in algebra

when he would have been challenged and successful in shop mathematics. Another student assigned to a shop math course may reveal a talent which calls for a more theoretical mathematics program.

Materials, information systems, and procedures can be developed which would allow a more flexible program so that students son't get locked into courses for long periods. One of the options in an individualized program would be to call for different students to work on different objectives within the same overall class and program.

(d) Same objectives, same materials, different time to completion. The example of a program in which all students achieve the same objectives with the same materials is a typical programmed course of the short frame, short answer format.

Each student answers the same questions, reads the same material, but they take different amounts of time doing it. The student is allowed to progress through the frames at his own rate, but he is locked into the material. A successful program is usually defined as one in which 90% of the students get 90% of the answers correct. There has been some very interesting research on this topic and the current November issue of your own Journal for Research in Mathematics Education has a provocative article on scrambled sequences.

(e) IPI program. (Entry level test, diagnostic pre-test, special unique assignments, and post-tests of mastery.) In an

individually prescribed instruction program, a student is given an entry level test. For example, items which measure whether he can add single digit numbers, two 2-digit numbers without carrying, two 2-digit numbers with carrying, two multi-digit numbers with carrying, more than two multi-digit numbers with carrying, etc., would determine a student's entry level in addition.

Once the entry level of a student in each area of the curriculum has been found, the student's profile of achievement can be made for areas such as numeration, place value, addition, subtraction, multiplication, division, fractions, geometry, etc.

From the profile of achievement the teacher decides what unit the student should begin to study.

The student is given a pre-test of the objectives of that unit.

The student works through instructional materials on the objectives for which he could not demonstrate mastery. Curriculum embedded tests act as checks of the student's short-term progress.

After the student has studied and seems to have mastery of all the objectives of a unit, he gets a post-test for that unit.

The student then moves on to another unit and the cycle repeats itself.

Students usually get achievement tests of one form or another about twice a year.

Theoretically, the student is always working on new material which he has not mastered and which is based upon material which he has mastered.

(f) Self-selected problems.(learning through problems - research.) A student may decide that he is interested in learning to program a computer. He then organizes his own efforts in a campaign to reach his goal. On the way he may learn many things in addition to learning to program a computer. For example, he may learn who the experts in his home area are. He may learn what schools and teaching materials are available and which are most suitable for a student with his abilities and background. The effort may lead him into by-paths such as the study of the kinds of projects which are using computers in his area. The important aspect of this kind of study is that motivation tends to be high since the student has made a commitment to the problem. The difficulties are that the student may become overspecialized, he may choose to ignore important fundamental principles in the subject, and his focus on the problem may make his study too narrow.

(g) Games and simulation are ways to individualize instruction. Each person makes his own moves and decisions according to his knowledge and background. By repititions of similar situations, the student gets to learn from his successes and from his previous mistakes. Motivation tends to be high and cooperative efforts among teammates and coaches are probable.

(h) Rich environment. There is a kind of individualized instruction which comes from immersing the student in a rich environment of machines, objects, materials, books, and people. Certain kinds of math laboratories show this kind of individualization. The student finds himself in the middle of people working on projects so that he has a model of the kind of activity expected of him. The teacher and the other students focus his ideas and direct him to select among the opportunities. There would be calculators, computers, raw materials for model construction, original investigations to be conducted, instruments and equipment which require mathematical abilities in order to use the instruments in an interesting way. There might be telescopes, planetaria, puzzles and games with a mathematical base.

As the student interacts with the rich environment, he is motivated by the "hands on" opportunities and by recognition of objects and activities which match his own interests. The teacher then has the responsibility to encourage and challenge the student to grow, learn, persevere and master mathematics both in direct relation to his activities and beyond.

Summary. The elements of an individualized program have been reviewed in order to emphasize the diversity of activities, materials, and procedures which can be used in an individualized program. Any given program may use some or all of them. The success of a program depends upon many factors. The role and activities of the

teaching staff are critical. There are many complex interactions between the attitudes and values of the staff and the expectations and self-concept of the students. Education is a human enterprise and the spirit which infuses any program can make an unbelievable difference.

Programs in existence. Now let us turn to some of the junior high programs in existende. The percentage of students who are engaged in programs which seriously attempt to individualize instruction at the junior high school level is very small. Therefore, most of the programs are formative and developing. Many of the programs involve special financial help and time for planning and writing materials.

Junior High IPI. Many students reach junior high school without mastering the basic computational skills and arithmetic concepts from the elementary school program. Sometimes the problem arises from the diversity of programs which feed students into the same junior high school. Furthermore, the Individually Prescribed Instruction program includes many advanced topics to accommodate the student who completes the usual objectives before he leaves the elementary school.

As a result, several junior high schools around the country have used the IPI program for some of their students. After completing the IPI objectives, they are prepared to deal with the concepts of the junior high school courses - algebra, geometry,

business arithmetic, or shop arithmetic. These programs then are using the diagnosis, prescription, and assignment-until-mastery-is-reached in order to bring their students up to a certain standard of skill and performance. After that, individualization may take place in other ways.

Project PLAN. Westinghouse Learning Corporation, in conjunction with the American Institute for Research, has developed an individualized program in several curriculum areas including aritimetic and mathematics. The goal is to have a "1 through 12" curriculum by September, 1971.

The program is computer-managed. Objectives and pre-tests are used to establish the student's need for learning activities. Lessons are usually assignments from presently available commercial materials which have been related to the sequence and objectives of Project PLAN.

There is an attempt to match the assignment of materials to some of the characteristics of the student. For example, an independent student may work up his own learning assignment and enter it into the computer bank of assignments so that future students may use it.

Westinghouse Learning Corporation provides a fairly complete package of services which include teacher training, the computer terminals, tests, and other ongoing services.

Dade County. Center for Self-Instruction. John Esposito,

Betty Thomas, and Diana Wilson, of the Dade County Center for Self Instruction in Miami, Florida, U.S.A., have prepared individualized self-instructional units for junior high school general mathematics. The materials have titles such as:

AVERAGES

EXPONENTS

FACTORS AND PRIMES

METRIC SYSTEM

RATIO AND PROPORTION

SETS

BASES

PROBABILITY

GRAPHING

SQUARES AND SQUARE ROOTS

NEGATIVE INTEGERS

SLIDE RULE

GATHERING VOCATIONAL INFORMATION - GRAPHS

AVERAGES COMMUNICATE INFORMATION - STATISTICS

THE HOUSEHOLD BUDGET

INTRODUCTION TO INSURANCE

AUTOMOTIVE TRADES

Altogether there are 64 self-instructional units which have been tried out in the Miami area. The materials have been tried in a variety of different kinds of junior high schools in the

Miami area. The units refer to pre-existing commercial materials wherever possible and generally try to use good ideas wherever the developers could find them.

There have been some shakeups in the Dade County School system and no further development of the program is occurring to my knowledge. However, the 64 packages do exist.

Nova. Nova High School of Fort Lauderdale, Florida has been active in the field of developing individualized materials and procedures. Math supervisor Larry Wantuck and his staff have developed many learning activity packages. The learning activity package, or LAP, is a guide for the student's efforts. It informs the student why the topic is important, what the student will be expected to be able to do as a result of his studies. The LAP includes a self-evaluation test and, most important, a guide to the learning activities and resources of the school. Often the LAP will inform the student of special procedures and times when he should have a conference with his teacher. Where deemed necessary, some new instructional material is written into the LAP.

The Nova math staff, using a federal grant and under the project direction of Mr. John Arena, has been developing junior high school math LAPs. The project is called Inter-Related Math and Science.

Even before the interrelated math and science program began, the Nova math staff had written many learning activity packages in

the junior high school math curriculum. Introduction to algebra and beginning algebra are the subjects dealt with in these older units.

The Inter-Related math and science project has developed materials in second year algebra and geometry. Some of the science LAPs, such as the one on the slide rule, have a strong math flavor.

Sample unit titles from the Algebra II sequence are:

MATHEMATICAL INDUCTION

POLYNOMIALS AND FACTORING

RELATIONS AND FUNCTIONS

COMPLEX NUMBERS

RINGS OF POLYNOMIALS

and a favorite topic of mine,

PROBABILITY AND STATISTICS

The geometry sequence includes units on:

LOGIC

A CLOSER LOOK AT PROOFS

PARALLEL LINES AND PLANES

COORDINATE GEOMETRY

SOLIDS AND THEIR VOLUMES.

Perhaps the titles will give you an idea of the position of the math department at Nova. They feel that the courses should convey the structure of mathematics and the mathematical approach to reasoning. This is to be compared with the argument that math

should be developed largely through its applications.

The IMS units are sent to several other schools besides Nova as part of the federal project, and the materials include a booklet entitled, "Information and Suggestions for Individualizing Instruction in the Secondary School." The booklet has chapters on behavioral objectives, the learning activity package and implementation in the classroom.

It is too early to report on an evaluation of the Nova packages.

Hopkins, Minnesots High School. Hopkins, Minnesota has been working hard to individualize its mathematics program. The group including Jim Whitney, one of the organizers of this meeting, does not take any of the standard lines about how to individualize. I get the impression of a serious attempt to help students who need help - the slow student, the unmotivated student, the student who might be bored by the lack of challenge in a program. The Minnesota program allows students to progress through a course in algebra or geometry at their own rate. Students who complete the course are permitted to study beyond the limits of the course. Students who are not ready for the next course have been helped by a summer course.

In the Hopkins program, under the direction of John Erickson, the students are given contracts which require about a week to complete. Tests are taken in a grading room which is staffed by

volunteers from the community. The grading system has a one-day turn-around time. Tests taken one day are corrected and returned by the next day.

The Hopkins school has been involved with a testing system called Comprehensive Achievement Monitoring, which uses computer analysis of periodic tests in mathematics in order to inform the teacher of which problems and concepts are giving the students difficulty and which ideas are getting across well.

An important characteristic of the Hopkins effort is that the program tends to move on the strength of the interest and ideas of the teachers. The senior staff members give leadership and introduce articles, ideas, speakers, and sometimes help in the way of time and funds, but the teachers carry the program forward.

Individualized Mathematics Teaching (IMU). Sweden has decided to individualize instruction throughout their school system in many important ways. One of the important projects is the IMU junior high school mathematics project, under the direction of Curt Oreberg. The organization and procedures of the IMU system are similar to those of the IPI system. However, from what I can tell without being able to read Swedish, the approach is sound mathematically and employs familiar examples and a humorous approach to clarify and illustrate concepts.

Some of the concepts covered by the IMU material are as follows:

Set concept, set diagram.

Number line, order, different sets of numbers.

Basic laws of arithmetic.

Power where the exponent is an integer.

Ratios, rough calculations, introduction to the slide rule.

Linear reflection.

Approximate values.

Congruence, the circle.

Drawing of functions. Simple formulas.

Reduction of expressions, introduction to the solution of equations and inequalities.

Vectors.

Descriptive statistics.

Similarities.

Linear functions, proportion, mathematical model.

The geometry of space, the calculation of volume.

Square roots, the theorem of Pythagoras.

Probabilities, standard deviations.

Trigonometry.

Second degree equations, second degree polynomials, derivatives.

Others. Since I accepted this assignment, I have become aware of several smaller programs started in a variety of situations and involving various interpretations of the best way to individualize.

These include a continuous progress program in the middle

school which offers the student a behavioral-objectives-based program with a variety of materials in different media. I also want to thank the chairman of the middle school math program of Milton, Mrs. Elizabeth H. Dobb, for the courtesy and completeness of her response to me.

There are individualized programs keyed to available commercial materials in Duval County in Florida; and Evanston Township High School in Illinois has initiated an individualized junior high program in one of its four schools.

Closer to Montreal, the Department of Mathematics of the North York Board of Education, outside of Toronto, is preparing a "K-13" mathematics curriculum with many aspects of individualization. The work is under the direction of Dr. John Del Grande.

Problems. All individualized programs have problems of organization and articulation. How do you keep the three-ring circus going so that students get what they need when they need it? What do you do about the students entering conventional programs which are not prepared for either the attitudes of the students or the wide range of experience which the students have had in the individualized programs? How do you keep the teacher from feeling that her most important role has suddenly become clerical and storekeeping?

How do you generate the resources of time and equipment without a federal grant? Planning time is essential, yet it is

one of the most difficult things to break loose from the system.

Another problem that occurs at the elementary school level is accentuated at the junior high school level. If the students are scattered all over the curriculum, how does the teacher deal with a question from a student? It is very difficult to spontaneously remember a proof or a line of reasoning to solve a problem on the spot. One of the best qualified teachers that I know uses a paced lecture system just because of this difficulty.

Another problem is that there are very few materials designed for individualized instruction on the market. Many teachers are not prepared, do not have the time, or are not motivated to write materials for individualized programs. The materials from other fprograms may or may not be suitable for a particular school and they may not be available. There are several programmed instruction books on the market; and just recently I began to see ads for junior high individualized materials in The Arithmetic Teacher and in The Mathematics Teacher. I sent off and ordered materials and asked for further information. Thus far, the materials I have seen are mostly remedial materials and would not serve a strong course which introduced a student to the structure and power of mathematical analysis. Nevertheless, it can be anticipated that commercial interests will slowly begin to enter this field.

Concern. There is a legitimate concern that reads something like this: "Before we go to all this trouble, what evidence is there

that the effort is worth it in terms of some benefit to the student?"

There have been several research studies and articles on various forms of individualized instruction. For example,

Designing an Algebra I Performance Curriculum for a Heterogeneous Student Population, by Kornhaber and Kappus.

The Junior High School Mathematics Program - Past, Present and Future, by Ferguson.

Report of a Study on the Use of Programmed Workbooks to Provide for Partially Individualized Mathematics Instruction in the Junior High, by Lach.

Behavioral Objectives and Flexible Grouping in Seventh Grade Mathematics, by Bierden.

Research on Mathematics Education, Grades K-8, for 1969, by Suydam, reviews eleven dissertation abstracts which report research on various aspects of individualized instruction.

What can we say from all of this?

(1) Don't expect dramatic improvement in either standardized test results or pre- and post-test results on criterion referenced tests. (Criterion referenced tests are composed of test items which specifically test the objectives you and the students are aiming at.)

(2) Most observers and research reporters seem to believe that there is something in individualized instruction which is

worth developing. The analogy is that of the newly invented motor car. If we had judged the motor car in its early days by its efficiency and ability to outperform the horse, we would have junked the development of the motor car. Individualized instruction is in its baby phase. I also feel that the development of improved models of individualized instruction has been seriously slowed down by a lack of imagination, a lack of invention, a slowness in communicating the ideas which must be understood before development of new models of individualization can take place. Engineers can design, develop, and build a new car whether anyone understands what is under the skin or not. Education isn't like that. Teachers' hopes, ideals, attitudes, and knowledge are part of the development process of a new idea in education. There must be a very close interaction between the development and the discussion which takes place among the teachers of the country.

(3) The attitudes and the enthusiasm of the teachers have an effect upon the comparison results between the individualized class and the traditional class.

(4) Individualized instruction programs seem to affect student attitudes toward mathematics, but this may be an effect of the novelty and excitement of the experiment.

(5) Many people like the style of individualized instruction independently of any obvious cognitive gains. Others, of course,

dislike the individualized programs for equally subjective reasons. It takes all kinds and that is probably a good thing.

(6) Individualized instruction in its various forms offers diversity. Even if we cannot prove superiority of one method or another, it is probably a good thing to continue the development and the conversation so that schools have a choice of instructional strategies.

(7) We need better ways of accumulating evaluative evidence with regard to innovative programs. There seems to be no way except for personal observation and personal preference to make a summary evaluation of the relative merits of individualized versus group-paced instruction.

Specifically, study after study shows "no significant difference" in achievement for different systems of class organization. Further, those studies that do show significant differences split between studies that favor individualized elements and those that do not. This is true in spite of the fact that a new system is usually introduced because something or someone says it is supposed to be better. Even in the studies that show an improvement for the individualized program, it is not established what is the causal factor. We cannot say why individualized instruction isn't more potent.

My personal view is that we are missing something. I suggest that most students need to know that a group of people is

doing something so that they can believe in that activity and work hard. Working alone at one's own pace does not have enough of this feeling about it. When an assignment is made to an entire class - even if the assignment is difficult or unpleasant, the knowledge that an entire group of classmates is wrestling with the problem may be an important motivating factor.

Another idea which appeals to me is that something significant happens in a group discussion. The student hears shadings of meaning through the way things are said as well as what is said. Further, the good students and the teachers serve as a model for the way the subject should be approached and developed.

Many individualized programs may have too narrow a focus. By too clearly defining what is to be learned, the student may not keep his mind open and scanning the subject for meaning. There is some evidence for this effect in two studies which I have seen. The message seems to be that the instructional material should not have too clearly defined goals before achievement is tested. When the subject material is not too carefully keyed to the test, the student seems to be looking for relationships and meaning in all parts of the material. Test questions and classroom questions then seem to cause the student to review and integrate the material in order to answer the questions. I know that this always seemed to be unfair when I was a student, but as I look back upon this effect, it seems to be there.

An analogy might be the difference between reading a book out of general curiosity and then discussing the book with a friends, and searching the book for a particular piece of information. When you search for a particular piece of information, you may get the information you seek, but you will almost certainly miss a lot that is in the book. When you read with an open mind and then discuss, all kinds of relationships may arise.

A key problem in individualized instruction which uses criterion tests is that of the criterion level. In many individualized programs we say that the student is tested to mastery. The truth as I see it is that we know very little about the proper levels of mastery and the proper criterion levels which we should seek for different children. Sometimes a student bogs down trying to achieve a mastery level when it would be better for him to move on with a lower score. The student may then (if allowed to move on) acquire the needed level of mastery as he uses the skill in some higher level of operation. For example, some students may be better off refining addition skills in doing multiplication problems. Other students may need absolute confidence in their ability to add before they can successfully learn the multiplication algorithm. There are studies by Stolurow that show that the very high degree of mastery of each step of a course is not always the best instructional strategy. In summary, we say that we individualize instruction, but we do not yet know how

to individualize the criterion performance levels which we expect at each step of the program.

I could go on with the aspects of individualized instruction that worry me. When you work in something for eight years, you accumulate a lot of problems. Solutions to problems are slow in education. Ofter, with a new movement, the problems are glossed over to keep enthusiasm going. The difficulty with such propaganda is that it doesn't educate. We have shown that individualized instruction can work in the sense that the sky doesn't fall down and some of the management and scheduling problems can be worked out. We are a long, long way from having an adequate, humane system of individualized instruction that people can entrust their children to.

Advice. From my experience I would like to make the following suggestions. The suggestions are not proven results; I only offer them for your consideration.

Time sharing. Use different aspects of individualized instruction for different purposes at different times. Use the diagnosis and prescription method to find and develop prerequisite skills which are lacking. Use class assignments, lectures, games, and seminars to capitalize on the effects of group interaction. Use independent study and research problems for the student who shows an in-depth response to these opportunities. Use competition and contests for students who are turned on by this effort.

Develop your own mixture of individualized elements and then do your homework to make the system work.

Plan. Get some competent advice from teachers and other people who have worked with programs that you admise. Then plan so that you can manage what you try to do. Start with enthusiastic teachers and with the support of the important leaders and administrators in your school. Get reprints and articles and books on the subject. They are much cheaper than consultants. Use the PERT planning technique if you are at all inclined that way. Properly done, PERT saves a lot of headaches and is a flexible tool for changing plans as new problems and opportunities arise. Make sure that you start by having planning time of at least two hours per week.

Assess your resources. Make a list of parents, community people, professors, older students, and other human resources. Make a list of sources of materials and equipment which can help the program. Typewriters, calculators, raw materials such as old books and graph paper can often be used in interesting ways. Make a math laboratory and a math resource center which is rich and varied. Then make a library card system so that you and the students can get what you need when you need it.

Organize and cross-index the materials, equipment and supplies according to topics and according to behavioral objectives. Each way has its advantages. Just as a library uses the author

and subject cards as a cross-index system, the teaching resource should use a topic and behavioral objective cross-index.

Curriculum. There are many ways to play the curriculum game. As with most problems, there can be too much democracy when what we really need is to get on with a program. On the other hand, sometimes the curriculum gets so out of touch with what anyone believes in or what anyone can use that it pays to take a look at what we are doing. I believe in a time sharing approach. There should be times when the students study what the teacher thinks is important or beautiful to learn. There should be time when the student has a say in what he studies in math, wither by electives or by self-chosen areas within a course. Finally, the community might take part in the conversation. I have seen many good results from lay members of a curriculum committee. A narrow interpretation of relevance can do considerable damage, but answering the questions of students and community people can be an important factor in developing the professionalism of mathematics teaching.

Documentation and evaluation. Feed some of your time and effort into the problem of documenting what is happening to your students, to yourself and to the program. Try to find multiple ways to evaluate the program. Do not be defensive, but really listen to gripes and criticism from all sources. Try to get as much outside evaluation as possible from people whom you respect

but who are not emotionally committed to the program.

Conclusion. I have seen enough instances in which individualized instruction rescued students who were hopelessly lost and miserable so that I want to have the instruments and techniques as a tool. I have also seen instances in which students have become hopelessly lost and confused in supposedly individualized programs which turned out to mean that nobody knew what anyone was doing.

There are a few fairly large-scale efforts such as junior high IPI and Project Plan. The commercial world is beginning to propare materials for individualized instruction. There are many teachers who are responding to the idea of individualization in their own way and with limited resources.

Planning and alertness to signals from students and others is necessary if individualization is to be a respectable tool for the teacher.

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INDIVIDUALIZATION OF INSTRUCTION IN JUNIOR HIGH SCHOOL MATHEMATICS

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